Code No: 117FE **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, April/May - 2018

MICROWAVE ENGINEERING

(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Draw the field pattern of TE_{10} mode in rectangular waveguide. [2]
b) Sketch microstrip line diagram and indicate important features. [3]
c) Draw the E-plane Tee junction diagram. [2]
d) Find the resonant frequency of an air-filled cavity resonator with dimensions a=5 cm, b=3=cm and d=4 cm. [3]
e) Draw typical Applegate diagram. [2]
f) Explain transit time effect in conventional tubes. [3]
g) What is mode jumping in cavity magnetron / how this can be avoided? [2]
h) Draw the diagram of IMPATT diode and carrier concentration. [3]
i) State the significance of S-Parameters at high frequencies. [2]
j) What are the possible errors in high frequency measurements? [3]

PART-B

(50 Marks)

2.a) Why TEM modes are not possible in hollow rectangular wave guides ?
b) A TE_{10} wave at 10 GHZ propagates in a rectangular wave guide of 1.5 cm × 0.6 cm dimensions filled with medium air. Determine guided wave length and wave impedance. [5+5]

OR

3. Derive the expressions for the field components due to TM waves in a rectangular waveguide. [10]

4.a) Describe the working of H-plane Tee and state why it is called shunt Tee.
b) A directional coupler is having coupling factor =10 dB and directivity = 40dB. Determine the power coupled in forward and reverse direction when input power is 10 W assuming the coupler is lossless. [5+5]

OR

5.a) With the help of diagram ,explain principles and operation of a 3-port circulator.
b) List and explain the characteristics of Ferrites. [5+5]

6.a) With the help of Applegate diagram, explain the bunching process and hence the velocity modulation in Klystron amplifier.

b) State the limitations of conventional tubes at high frequencies. [5+5]

OR

7.a) Classify the various microwave tubes with respect to the orientation of electric and magnetic fields.

b) Explain with neat sketch, the principle of operation of a TWT amplifier and write the equations for the maximum voltage gain and efficiency. [5+5]

8.a) Derive equation for Hull cut-off voltage in a Magnetron.

b) Explain the principle of operation of cavity magnetron and discuss phase focusing effect? [5+5]

OR

9.a) Discuss in detail the principle of operation of GUNN diode considering the two valley model theory and sketch its volt-ampere characteristics.

b) An n-type GaAs GUNN diode has the following specifications:

Threshold field	3kV/cm
Applied field	3.5 kV/cm
Device length	10 micrometers
Doping constant	10^{14} electrons/cm^3
Operating frequency	10 GHz

Calculate the current density (-ve) and electron mobility in the device. [5+5]

10.a) Find the S-matrix of a magic Tee.

b) Explain the double minima method of measuring VSWR. [5+5]

OR

11.a) Describe how the frequency of a given microwave source can be measured Using two different methods.

b) What are the different possible errors that will effect VSWR measurements? [5+5]

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